RTI Project Number
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Calculation of Charge-Based Relative Values for Laboratory Tests

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ANALYSIS PLAN

CMS Contract No. 500-95-0061/T.O. #2

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Prepared for

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1. INTRODUCTION

Medicare is the largest payer for clinical laboratory tests in the nation, covering inpatient and outpatient testing for the elderly and disabled. The Institute of Medicine (IOM) recently undertook an exhaustive assessment of the current payment system used for reimbursement of outpatient laboratory tests by Medicare Part B. Medicare Part B covers outpatient laboratory tests performed by independent laboratories, physician office labs, hospital outpatient departments, and other non-inpatient facilities. Current payment rates for outpatient tests are set according to a prospective system based on 1983 customary charge data and implemented in 1984 with labs being paid the lesser of submitted charges or a fee schedule amount. Initially, payment rates under the fee schedules were set separately in each of 56 geographic jurisdictions, limited by a national cap. The 75th percentile of 1983 prevailing charges defined the fee schedule amounts in each of the 56 areas, and a mechanism was used to update the fees annually, based on the change in the Consumer Price Index (CPI). For most years, however, Congress has specified lower update factors. Currently, national caps called National Limitation Amounts (NLAs) set ceilings on payment rates for most procedures (designated by HCPCS code, the Centers for Medicare and Medicaid Services' [CMS's] common procedure coding system). Although the NLAs constrain most fees in most areas, the 56 separate fee schedules are still operational. Thus, current reimbursement is the lesser of the submitted charge, regional fee schedule, and the NLA payment rate.

Constraints on payments have led to a decline in actual Medicare expenditures for laboratory tests, while expenditures for most other medical services have continued to rise. Moreover, the system has evolved very arbitrarily over the past two decades with key decisions regarding coverage, payment, and medical necessity made both nationally and locally by private Medicare administrators. Many changes at local and national levels over time have resulted in an extremely complex system. Concerns about how well Medicare reimbursements reflect current costs of lab testing and about the ability of the system to keep up with anticipated changes in technology prompted Congress to direct CMS to commission the IOM study.

The IOM report "Medicare Laboratory Payment Policy, Now and in the Future," recommends that Medicare payments for outpatient clinical laboratory services should be based on a single rational national fee schedule. The building blocks for this system would be

- a relative value scale (RVS);
- a dollar conversion factor that transfers relative values into payment amounts;
- adjustments for laboratory, beneficiary, or other characteristics, including geographic location; and
- periodic updates.

The report recommends that, on an interim basis, relative payment amounts should be based on the current NLAs. In the longer run, the report recommends that a data-driven consensus process for refining the fee schedule should be developed. The report suggests four approaches for gathering the data and recommends that CMS should explore the alternative methods:

- Microcosting. Studies would be conducted to determine the costs of individual procedures. This approach could be used to set both the RVS and the conversion factor, or just the RVS.
- A competitive bidding demonstration. In principal, this approach could be used to set both the RVS and the conversion factor. However, the IOM report recommends using this approach only to set the RVS.
- A negotiated fee demonstration. This could be used to set both the RVS and the conversion factor, or just the RVS.
- Analysis of charges. Under this approach, charge data would be used to set the RVS but not the conversion factor.

In response to a Task Order issued by CMS in 1998, the University of Wisconsin–Madison, RTI, and Northwestern University were awarded a contract to design and implement a competitive bidding demonstration for Medicare laboratory tests. After the publication of the IOM study, our contract was modified so that we are now charged with developing charge-based relative values for Medicare laboratory tests.

In this analysis plan, we describe our strategy for calculating and reporting charge-based relative values using data from the Physician/Supplier Procedures Summary File. First, we discuss the advantages and disadvantages of using charge-based data to help inform the development of a final, consensus-based RVS. We stress that development of this final RVS is beyond the scope of this study. In this study, our scope of work is limited to analyzing charge data, developing charge-based relative values, and providing comparisons across several hypothetical fee schedules. The comparisons show how fees would change if a new price schedule were to be based on relative values, and we explore how sensitive the relative values are to various partitions of the charge data. These analyses are meant to inform CMS about properties of the existing charge data, as a point of departure for possible future development of a consensus-based relative value scale.

Second, we describe several approaches for collecting and using charge data, and their advantages and disadvantages, in order to justify the data collection approach we adopt. We discuss advantages and disadvantages of several data sources in order to justify the source we use for the analysis.

Third, we describe the methodology that we plan to use in calculating the charge-based relative values. We formalize our approach of comparing the charge-based relative values to those implied by the existing NLAs. We describe subanalyses that we will perform to calculate separate charge-based relative values for different subsets of the data, including independent

and physician office labs and/or by procedure (HCPCS code) category, region, or volume. We describe sensitivity tests that we will perform to determine whether relative values based on subsets of the data are significantly different from those calculated using all of the data. We then construct a hypothetical expenditure-neutral pricing system based on the relative values, and provide a procedure-specific comparison of how current reimbursements would be affected by implementation of a pricing schedule based on the RVs. We repeat this using expenditure-neutral NLA-based RVs compared with current charges. Finally, we describe how the results are to be reported.

As part of the project, we delivered a preliminary draft of this analysis plan to consultants who have expert knowledge of the laboratory industry and Medicare pricing mechanisms. This revised analysis plan incorporates their comments. Our next task is to conduct the analysis based on the revised plan.

2. JUSTIFICATION

2.1 Advantages and Disadvantages of the Charge-Based Approach

Ideally, the new RVS to be used in the Medicare laboratory fee schedule would accurately reflect the relative costs of different procedures (as defined by HCPCS codes). If procedure A costs twice as much to produce as procedure B, then procedure A's relative value should be twice as high as procedure B's relative value. The rationale for using charges to determine relative values is that charges may be systematically related to costs.

We know that prices and submitted charges are consistently higher than the net prices actually received by labs (i.e., the amount labs are actually paid after subtracting contractual discounts and other allowances). Thus, under the reasonable assumption that net prices are greater than or equal to the costs of each lab procedure, it is clear that we cannot claim that submitted charges provide an accurate measure of costs. However, if prices are marked up over costs by the same percentage for all procedures, relative prices will provide an accurate measure of relative costs because the markup factor will cancel out of both prices. For example, suppose that the markup rate over cost is 80 percent for both procedures A and B, which have costs C_A and C_B and prices P_A and P_B, respectively. Then $P_A = 1.8\ C_A$, $P_B = 1.8\ C_B$, and the relative price of A with respect to B = $P_A / P_B = C_A / C_B$.

Using standard economic theory, it is possible to generate relative prices that accurately reflect relative costs. Assuming firms maximize profits, they will set prices at the point where their marginal revenue equals marginal cost. This equation can be written as

$$P_1 (1 - 1/E_1) = MC_1 \qquad (1)$$

where P_1 is the price of procedure 1, E_1 is the elasticity of demand for procedure 1, and MC_1 is the marginal cost for procedure 1. If we divide the equations for procedures 1 and 2, we get

$$\frac{P_1(1 \quad 1/E_1)}{P_2(1 \quad 1/E_2)} = \frac{MC_1}{MC_2} \tag{2}$$

If the elasticity is the same for both procedures, the equation simplifies to the following:

$$P_1 / P_2 = MC_1 / MC_2 \tag{3}$$

In this case, relative prices accurately reflect relative costs.

The preceding analysis relies on a number of assumptions. The result that relative prices reflect relative costs may not hold if the assumptions are violated. These violations could occur in several ways. First, elasticities may differ across different HCPCS codes. This may be true for newer tests that are more reliable, thus exhibiting less elastic demand (and higher markups). Second, the marginal costs may themselves be a function of the extant pricing schedules, to the extent that price distortions in the fee schedule distort technological investment and diffusion. Third, firms may not act rationally to maximize profits. Fourth, complementarities or substitution effects may confound the relative costs and elasticities, especially if the profit maximization strategy is a more complicated product bundling scheme. Fifth, marginal costs for the same HCPCS codes may vary across firms for a variety of reasons, including scale of operations. Finally, labs may not set their charges (list prices) in a systematic way, because these charges are seldom used to set reimbursement rates.

Despite the potential for violations of our assumptions, we believe that analyzing charges is still a useful starting point in the development of a consensus-based RVS. The assumption that labs base charges in part on costs is reasonable because even if labs do not know the per-unit costs for tests and procedures, they do most likely have a knowledge of the relative costs, which is all that is required for a charge-based RVS to work. We can, based on these assumptions, provide analysis of relative values based on charges, present these findings to industry experts, and see if they have face validity. This analysis is useful as a starting point for further investigation, which can be directed by specific anomalies (or lack thereof) found in our analysis.

In summary, the charge-based approach has advantages and disadvantages:

Advantages

- Charge data are readily available. Under the current reimbursement system, laboratories submit charges to Medicare, and these charges are captured electronically. In addition, laboratories have price schedules that they use to charge their customers. In contrast, laboratories do not submit cost information and do not generally compile information on the cost of individual procedures. For a number of reasons, developing a microcosting approach could be difficult. Demonstration projects to negotiate fee schedules or conduct competitive bidding would also have to be designed and implemented. None of these approaches could be accomplished as quickly as performing an analysis of charge data.

- The charge-based relative values might identify procedures that are most likely to be over- or under-priced under a payment system based on the NLAs. Identifying these procedures could allow CMS or an expert panel to make adjustments in fees in the interim payment system, based on NLAs, prior to adoption of the long-term rational fee schedule envisioned by the IOM.
- Charge-based relative values could provide a starting point for a negotiated or consensus approach for setting an RVS. The consensus approach could be facilitated if the charge-based relative values generally have face validity.
- A charge-based NLA could also be used as a benchmark for evaluating other approaches.

Disadvantages

- Relative charges may not reflect relative costs if markups over cost differ between procedures. As noted above, the fact that submitted charges bear little resemblance to net prices will not pose a problem for forming an RVS if submitted charges are consistently discounted by the same percentage. If markups differ between procedures, the systematic relationship between costs and charges will be lost. Unfortunately, there is little evidence on whether percentage markups are constant across procedures.
- Labs may have incentives to distort future charge levels if the charges are used to set a fee schedule. However, this incentive will be diluted if charges are only used to set the RVS and not the conversion factor and by the fact that each lab has a relatively small impact on the overall distribution of relative charges.

As noted above, one of the disadvantages of the charge-based approach is its reliance on the assumption that prices are marked up over costs by the same percentage for all HCPCS codes. Perhaps a more reasonable assumption is that the percentage markups are approximately equal for certain groups of HCPCS codes—for example, HCPCS codes in a product class such as microbiology or hematology, HCPCS codes conducted within the same geographic regions, or HCPCS codes conducted at comparable production sites (e.g., physician labs or independent labs). To address this, relative values based on these alternative assumptions can also be calculated.

Weighing the advantages and disadvantages, we adopt the charge-based approach because charge data are readily available, and it is reasonable to assume that charges for individual procedures are correlated with procedure costs. At the same time, the disadvantages cannot readily be dismissed. The possibility that markups differ between procedures can be ameliorated by calculating separate charges for procedures grouped by type, region, and production platform.

We believe that the charge-based approach can contribute to the development of a rational RVS for pricing purposes. But given the aforementioned difficulties, we recommend that charge data be used as one of the sources in the development of the RVS but not the only source. Charge data could be used as the starting point for a consensus panel of experts, who can

make adjustments based on their expertise or experience, or as a benchmark for comparing the results of other approaches for developing the RVS.

2.2 Advantages and Disadvantages of Various Approaches for Collecting and Analyzing Laboratory Charge Data

At least two approaches could be used to collect and analyze laboratory charge data. We discuss the advantages and disadvantages of each approach.

Approach 1: Analyze existing charge data that are collected as part of the current reimbursement system.

Advantages

- Data from independent and physician office labs are readily available in electronic data format at both the summary and individual claim levels.
- Data can be analyzed at a variety of levels—by lab, aggregated across labs, aggregated across regions, etc.
- Charges can be weighted by the number of tests performed by each lab.
- Relative values could be set for all procedures with submitted charges.

Disadvantages

- General disadvantages of any charge-based approach (see General Advantages and Disadvantages of the Charge-Based Approach).

Approach 2: Conduct a survey of lab prices, allowing labs to provide price catalogs or fill in a spreadsheet of prices by HCPCS codes.

Advantages

- Provides a periodic, random survey of laboratory prices.

Disadvantages

- Surveys are relatively costly and require clearance by the Office of Management and Budget, lengthening the data collection process.
- To minimize survey burden on laboratories, it would probably be necessary to limit the number of procedures for which information is collected. The bulk of laboratory allowed charges could be covered in the survey by asking for information on about 100 common laboratory procedures. Such a limitation would not provide information for setting prices for rarer procedures, however.
- Laboratories may be reluctant to respond to surveys, even if they are limited to common procedures.
- Physician office labs and other small labs account for the vast majority of all labs, but hospital and independent labs perform the vast majority of tests. It would require an

elaborate sampling frame to select labs on the basis of test volume. Response rates are likely to vary by type and size of lab in a manner that is likely to yield biased estimates of relative prices.

- To analyze the data, we would have to decide whether to simply average prices across responding laboratories or weight responses by each lab's volume. Although the simple average is the easiest to calculate, it gives as much weight to a lab that performs 1 unit of a procedure as it gives to a lab that performs 100,000 units of a procedure. Alternatively, if weighting is used, information on volume would have to be collected, doubling the amount of information that must be collected on each procedure.
- It is not clear whether the laboratories' response to a survey would yield higher quality information about relative costs than submitted charges. At the same time, a survey is much more costly and time-consuming than an analysis of submitted charges. Thus, a survey may not be worth the additional expense.
- General disadvantages of any charge-based approach (see General Advantages and Disadvantages of the Charge-Based Approach).

We adopt Approach 1, using reimbursement data, because it is less expensive and can be adopted more quickly than Approach 2. Moreover, we believe that the analysis of relative values will be greatly enhanced by using the volume information available in Medicare charge data.

2.3 Advantages and Disadvantages of Various Data Sources That Could Be Used for an Analysis of Submitted Charge Data

There are two primary data sources for an analysis of Medicare submitted charge data. Both sources have advantages and disadvantages.

2.3.1 The Physician/Supplier Procedure Summary File

This file contains laboratory procedures (by HCPCS code) processed by Medicare Part B carriers. Included tests are performed by independent and physician office labs. Claims are aggregated across individuals and laboratories.

Advantages

- This data file is much smaller than individual claims data set, facilitating analysis.
- Separate analyses can be performed for physician office and independent labs, region, type of procedure, etc.

Disadvantages

- Individual laboratory data cannot be extracted from the summary.
- The data file does not include hospital laboratory claims that are covered by Part B but paid by fiscal intermediaries. Unfortunately, there is no corresponding summary file for

Part B hospital laboratory claims; moreover, individual hospital outpatient claims contain total submitted charges for the entire claim but not for individual procedures.

- It is possible that some labs will submit charges that are equal to current fee schedule amounts, even though their regular prices are higher than the fee schedule amounts. We will not be able to observe how frequently this occurs using the summary data. In an exploratory analysis for this study, we examined the relationship between submitted and allowed (actual) charges in a 5 percent sample of individual lab claims from Medicare's 1999 Laboratory Standard Analytic File. Over 90 percent of the claims had submitted charges greater than allowed charges.

2.3.2 The Laboratory Standard Analytic File

This file includes individual laboratory claims processed by Medicare Part B carriers. Included tests are performed by independent and physician office labs.

Advantages

- The individual claims data allow for development of comprehensive charge schedules for individual laboratories. This information could be used to calculate relative charge schedules for individual labs.
- Additional data on the distribution of charges by procedures could be calculated (e.g., median, 25th, and 75th percentile charges).
- We would be able to determine how frequently labs submitted charges equal to the fee schedule amounts. However, we would not be able to tell if these submitted charges represent the firm's usual prices. It has been our experience that submitted charges are almost always higher than allowed charges. In an exploratory analysis for this study, we examined the relationship between submitted and allowed (actual) charges in a 5 percent sample of individual lab claims from Medicare's 1999 Laboratory Standard Analytic File. Over 90 percent of the claims had submitted charges greater than allowed charges.

Disadvantages

- Analyzing the file requires reading and manipulating approximately 300 million claims annually. Calculating average charges for up to 1,100 procedures for up to 200,000 laboratories would require large computer storage resources and significant amounts of computer time.
- Even if we could compute RVS for individual laboratories, it is not clear how we would compare the different scales and whether or how we would aggregate the scales to provide useful guidance to policy makers.
- The data file does not include hospital laboratory claims that are covered by Part B but paid by fiscal intermediaries. Unfortunately, there is no corresponding summary file for Part B hospital laboratory claims; moreover, individual hospital outpatient claims contain total submitted charges for the entire claim but not for individual procedures.

We adopt the Physician/Supplier Procedure Summary File because we want to perform this analysis relatively quickly, and the resulting relative values would be fairly easy to interpret. Current project funding is sufficient to support this analysis.

3. METHODOLOGY

3.1 Data

We will analyze the most recent Physician/Supplier Procedure Summary Master file. The file includes information from all Part B claims (principally outpatient claims) submitted to Medicare for reimbursement. The data are aggregated at the HCPCS code, physician supplier specialty code, carrier number, locality code, region code, service type, and place of service level. We will further aggregate the submitted charges (net of denied charges) and total services count (net of denied services count) to the HCPCS code level. We will only examine HCPCS codes that are used in the Clinical Diagnostic Laboratory Fee Schedule. Initially, we will include all labs in the analysis. We describe subanalyses below that will be performed on subsets of laboratories, such as physician office labs and independent labs. To perform these analyses, we will aggregate the data to the type of lab level.

3.2 Derivation of Relative Charges

The first step is to calculate the average submitted charge for each procedure (HCPCS code) by dividing the total submitted charges by the total services count. Next, we need to divide the average charge for each HCPCS code by a numeraire. Ease of interpretation and comparability between relative value scales are the primary considerations when choosing a numeraire. Within a single relative value scale, relative values are invariant to the choice of numeraire. For example, suppose that procedure A has a price of 1 and procedure B has a price of 2. If A is chosen as the numeraire, A will be associated with 1 relative value unit and B will be associated with 2 relative value units. Conversely, if B is chosen as the numeraire, A will be associated with 0.5 relative value units and B will be associated with 1 relative value unit. In both cases, there will be 1:2 ratio between A and B's relative values.

Given the invariance of relative values to the choice of numeraire, we propose to choose a numeraire that is easy to interpret. Possibilities include a weighted average of the submitted charges (with weights based on the volume of each procedure), or the submitted charge for a common procedure. The main advantage of using the average charge as a numeraire is that we can readily interpret the relative charge for an individual procedure as being proportionally lower or higher than the average charge for all procedures. Alternatively, the advantage of using the charge for a common procedure as the numeraire is that the common procedure may provide a useful benchmark for industry experts in assessing relative values.

Ultimately, we will compare relative values based on charges to relative values that are generated from NLAs. For this comparison, the choice of numeraire *does* matter, in a way that

favors the use of average prices as the numeraire. Different relative value scales can be generated using submitted charges or NLAs. If the scales have the same conversion factor, we will be able to directly compare the relative value units across the different scales. It can be shown that the conversion factors associated with each of the scales will be the same if the numeraires are based on the average submitted charge and average NLA, respectively. If the numeraires were instead based on a common procedure's submitted charge or NLA, the conversion factors associated with each scale would be different and we would be unable to directly compare the relative values across scales. Therefore, we recommend setting the numeraire for the charge-based relative value scale equal to the average charge for all procedures, and setting the numeraire for the NLA-based RV scale equal to the average NLA.

In addition to the main analysis, which will use data for all HCPCS codes, we will also perform separate analyses for each major class of HCPCS codes. We have identified 10 classes: Auto Test Panels (ATP02-ATP22), Drug Monitoring (80031–80042), Panels (80050–80099), Urinalysis (81000–81099), Chemistry and Toxicology (82000–84999), Hematology (85000–85999), Immunology (86000–86999), Microbiology (87001–87999), Cytopathology (88104–88199), and Cytogenetic Studies (88230–88299). In class-specific analyses, we will calculate relative values and numeraires by class, using only data from each individual class. We will calculate relative values for the NLAs in a similar fashion. For example, the numeraire for a NLA-based RV for a HCPCS code in class 1 is the volume-weighted average of the NLAs for all HCPCS codes performed within this particular class.

One reason for performing class-specific analyses is that demand elasticities may vary less within classes than they vary across classes. As equation (2) indicates, relative prices will better reflect relative costs if the elasticities of demand are similar across procedures.

3.3 Comparison of Charge-Based Relative Values to Relative Values Based on the National Limitation Amount

We will compare the relative values derived in the main analysis to relative values derived from the NLA in the Clinical Diagnostic Laboratory Fee Schedule. We will perform a Kolmogrov–Smirnov equality of distributions test to determine whether this pair of relative values are distributed in a similar manner. A significant test statistic (low p-value) would suggest that the distributions are not the same, so that for at least some HCPCS codes, pricing would be quite different under the two systems compared.

Next, we will calculate the deviation between the charge-based relative values and the NLA-based relative values. We will rank the HCPCS codes from the largest (in absolute value) to the smallest deviation and assign each HCPCS code to a quartile based on the size of the deviation. We will then examine the HCPCS codes in the top quartile more closely. We may be able to link many of the deviations to the nature of the procedure, and some of these deviations may be linked to cost or behavioral factors. However, the size of the deviation may be due to data characteristics that are unrelated to the underlying cost of performing the procedure. For

example, the average charge of low volume procedures (for example, less than 100 procedures in a given year) may be more sensitive to outliers than a high-volume procedure. Thus, the resulting relative value may reveal more about the peculiarities of the individual HCPCS code than its true underlying cost or behavior. We will address this issue in more detail in the sensitivity analysis described in Section 3.4.

We will also compare the relative values calculated separately for each class of HCPCS code to those calculated similarly from the NLA. We will conduct the Kolmogrov–Smirnov equality of distributions test for each class, and as described above, we will identify HCPCS codes having charge-based relative values with large deviations from the NLA relative values. We will again evaluate whether these deviations are due to differences in the underlying behavior or cost of performing the procedure, or inconsistencies in the data used to calculate the relative value.

Finally, we will graph the relative values based on submitted charges along with the relative values based on the NLA.

3.4 Sensitivity Analysis

All sensitivity analyses will be performed for all HCPCS codes taken together (main analysis) and then separately for each of the 10 classes of HCPCS codes (subanalyses). The purpose of the sensitivity analysis is to test whether the relative values are robust to changes in the sample subsets over which they are calculated, in order to better understand variation in relative values. Some of this variation is expected due to noise in smaller samples (low volume versus high volume procedures), and some variation has natural policy implications. For example, it may be interesting to know whether independent and physician labs exhibit a difference in the significance levels for their deviations between the charge-based and the NLA-based RVs.

3.4.1 Procedure Volume

Many of the procedures may be performed rarely. Because we rely on the law of large numbers to be confident that our average charge for a procedure is close to the true value in the underlying distribution, we expect that low-volume procedures may produce less reliable average estimates. As a sensitivity analysis, we will exclude those HCPCS codes with volume less than 100 units from our calculation of the relative values (including calculation of the numeraire) and compare the resulting relative values to the NLA to see whether the exclusion produces different results than the main analysis. We will repeat the comparisons performed in the main analysis and draw conclusions as to whether limiting calculations of the relative value to HCPCS codes with more than 100 units of volume is the best way to proceed.

3.4.2 Type of Lab

For policy purposes, it may be necessary to decide whether all labs should receive the same fees, or whether fees should differ by type of lab (independent vs. physician office labs). Relative charges may vary by type of lab. For example, procedures with significant economies

of scale and scope might have lower charges at independent labs than physician office labs, and relative costs may differ between lab types. To shed light on the relative cost issue, we will calculate the relative values separately for each type of lab, and test whether the distribution of lab procedures is different for physician office labs and independent labs. We will graph the relative charges for each type of lab and perform a Kolmogrov–Smirnov equality of distributions test. We will identify which HCPCS codes vary significantly depending upon whether they were performed at a physician office lab or independent lab. We will posit that the differences are due to behavioral differences in lab pricing, differences in the underlying cost of the procedure, or inconsistencies in the data, such as insufficient volume.

3.4.3 Location

Policy makers may be interested in knowing whether absolute and/or relative lab costs differ between regions. True differences might warrant geographic adjustments to any new fee schedule. While absolute charges are likely to vary depending on the location where the procedure is performed, relative charges should not. We will calculate relative values for the 10 different geographic regions of the country identified in the claims data (e.g., Northeast, Mid-Atlantic, Southeast, etc.) and check whether the distribution of relative values is similar across regions. Any regional variation may be due to the type of labs that are predominantly used in each region. For example, regions where physician office labs are often used may have different relative charges than regions where independent labs are dominant. Thus we will also compare the regions within each lab type. As in the other analyses, we will graph the relative values for each group in addition to performing the Kolmogrov–Smirnov equality of distributions test.

3.5 Comparison of Various Payment Systems

3.5.1 Current Payments vs. an Expenditure-Neutral Charge-Based Relative Value Fee System

We will compare average fees based on the current system of allowed charges (which is a blend of regional fee schedule amounts, the NLA, and submitted charges) with fees based on a hypothetical expenditure-neutral system incorporating the charge-based relative values. To do this, we first calculate the average price per test under current payments as total expenditures per HCPCS code divided by procedure volume. This average is our estimate of the current allowed price (P_i^a) for each HCPCS code.

$$P_i^a = \text{total expenditures for procedure i / total volume for procedure i} \quad (4)$$

Next, we establish a conversion factor that will make movement from the current payment system to the relative-value charge-based system expenditure-neutral. The conversion factor (CF) is defined as the ratio of total current expenditures for all HCPCS codes divided by the sum of quantity-weighted relative values for each procedure:

$$CF = \frac{\text{Total Current Expenditure}}{\sum_i (RV_i * Q_i)} \quad \text{for I = 1, 2,…n different test procedures} \qquad (5)$$

Thus, the new payment system is revenue-neutral because $\sum_i (RV_i Q_i) * CF$ = Total Current Expenditure.

With the conversion factor in hand, we then calculate the "converted" charge-based fee for each procedure (P_i^c) as:

$$P_i^c = CF * RV_i \qquad (6)$$

We then compare this expenditure-neutral fee (P_i^c) with the average fee in the current system (P_i^a). This allows for assessment of how fees for particular HCPCS codes would likely be affected by movement from the current mixed-rate system to an expenditure-neutral system with charge-based relative values.

3.5.2 Current Payments vs. an Expenditure-Neutral NLA-Based Relative Value Fee System

This analysis is similar to that described above, with the substitution of the NLA-based relative values for the charge-based relative values in equations (5) and (6). We thus derive a second expenditure-neutral fee based on the NLA RVs, which we label P_i^{NLA}. This comparison is of interest because a consultant to the IOM study estimated that, if a national fee schedule based on the NLAs were to replace the current mixed regional system, to maintain the current level of expenditure the NLAs would have to be reduced by 1 to 2 percent. This suggests that the NLAs are not always the lowest payment rates and that a small proportion of tests are now reimbursed at rates lower than the NLA.

3.5.3 Three Way Comparison

We compare the three fee schedules—P_i^a based on current allowed charges, P_i^c based on an expenditure-neutral charge-based system, and P_i^{NLA} based on an expenditure-neutral NLA-based system. These comparisons are provided in a Table by HCPCS code.

3.6 Reporting Results

The final report for the project will summarize and interpret the analytical results. Analytical results will be summarized in a series of tables and graphs. For the main analysis, we will first present a graph plotting all of the charge-based relative values against the NLA relative values. The graph will provide a useful overview of how closely the charge-based relative values compare to the NLA relative values. For example, if the charge-based relative values everywhere equal the NLA relative values, the plotted points will form a line at a 45-degree angle. If the charge-based relative values differ from the NLA relative values, the plotted values will show clear deviations from the 45-degree line.

Inspection of the graph may lead to qualitative conclusions about the relationship between charge-based relative values and NLA relative values. We will supplement these qualitative

conclusions with information from the Kolmogrov–Smirnov equality of distributions test statistic. Results from the Kolmogrov–Smirnov test will be presented in a tabular format.

We will present the main analysis results for individual HCPCS codes in tables. For each HCPCS code, we will present procedure name, average submitted charge, NLA, volume of tests, charge-based relative value, NLA relative value, deviation, and deviation quartile.

Similar graphs and tables will be reported for the subanalyses by HCPCS code class and the sensitivity analyses for procedure volume, type of lab, and location.

In a separate table we will present for each HCPCS code the current average payment, the fee that would obtain if based on the NLA or on submitted charges (with adjustments to maintain expenditure-neutrality).

In interpreting the results, we will focus on both policy relevance of the findings and how the relative values can help inform the development of a final, consensus-based relative value scale. Our report will also briefly discuss how insights from the development of the Medicare fee schedules for hospital inpatient and physician services can inform the development of a laboratory fee schedule. We will stress, as we have done in this analysis plan, that the charge-based relative values can inform development of the final RVS, but that much future work will remain.

4. DISSEMINATION OF THE REPORT

The report will be distributed to expert consultants for comment. We will present study findings to CMS staff and the general public in an open meeting at the CMS central office. We will invite the expert consultants to discuss the report at the meeting.

5. SCHEDULE FOR WORK

In Figure 1, we give the proposed timeline for completion of the project.

Figure 1. Proposed Timeline

Tasks	2001						2002
	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Task 1: Develop Analysis Plan							
Task 2: Receive Comments on Analysis Plan and Revise Accordingly; Receive Permission to Obtain Data							
Task 3: Perform Analysis							
Task 4: Report Results							

Addendum:
A Description of the Kolmogrov–Smirnov Equality of Distribution Test

The purpose of the test is to assess whether the revenue-neutral prices calculated using submitted charges have the same empirical distribution as the NLA price. The test requires several assumptions. First, assume true costs are distributed as F(C). Then, if markups are constant over all products, the revenue-neutral prices will also be distributed F(C), which we define as the empirical distribution of revenue-neutral prices calculated using submitted charges. Define the empirical distribution of NLA prices as G(C).

Using the Kolmogrov–Smirnov test we can test whether two sets of prices are generated by the same underlying distribution by testing the null hypothesis that G(C) is equivalent to F(C). If we reject the null hypothesis, we can conclude that the distributions are significantly different. In the next paragraph, we describe the mechanics of the test and how it compares with some more commonly used tests, such as the two-sample t-test of means or the simple Pearson correlation coefficient. Note that we propose to graph each set of relative values and visually assess whether the prices are equivalent in practice. We do so because the statistical test may reject the hypothesized equality of distributions when only one or two prices vary significantly. Thus, the test may reject comparisons that are equivalent in practice, with the exception of the prices of one or two HCPCS codes. As described in the analysis plan we will apply this test to other sets of prices, such as comparisons of prices at physician owned versus independent labs.

The test is implemented in many statistical software packages. For example, it can be conducted using the “ksmirnov” command in STATA or the “KS” command in SYSTAT. This test is based on the difference between two cumulative distribution functions, so the sample sizes must be the same. The test essentially compares the means, standard deviations, and shapes of the two distributions. In contrast, the more commonly employed two-sample t-test compares means of distributions only. For normal distributions, location (mean) and scale (units of observation) totally determine the shape, so the t-test is essentially equivalent to the Kolmogrov–Smirnov test when distributions are normal (however, the t-test is more powerful because it is based on more information via the assumption of a normal distribution). Similarly, the commonly used Pearson correlation equates location and scale, so the Pearson correlation coefficient can be a perfect “1” even in cases where the two compared distributions are quite dissimilar. That is, for other distributions besides the normal distribution, location and scale may not be enough to determine equivalence of distributions. When we employ the Kolmogrov–Smirnov test, we assume that both sample distributions come from exactly the same population distribution, but we make no assumptions about what form that distribution takes (thus, the Kolmogrov–Smirnov test is dubbed a “distribution free” test).